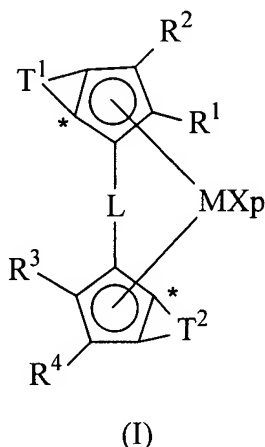


AMENDMENTS TO THE CLAIMS

1. (currently amended) A process for preparing isotactic 1-butene copolymers ~~having a content up to 30% by mol of units derived from at least one alpha olefin of formula $\text{CH}_2=\text{CHZ}$, wherein Z is a $\text{C}_3\text{-C}_{20}$ hydrocarbon group, the process comprising contacting 1-butene and~~ the at least one alpha olefin of formula $\text{CH}_2=\text{CHZ}$, wherein Z is a $\text{C}_3\text{-C}_{20}$ hydrocarbon group under polymerization conditions, in the presence of a catalyst system obtained by contacting:
- a) at least a metallocene compound of formula (I):



wherein

M is a transition metal belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

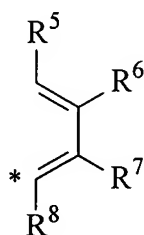
X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO_2CF_3 , OCOR , SR, NR_2 or PR_2 groups, wherein R is a linear or branched, saturated or unsaturated $\text{C}_1\text{-C}_{20}$ alkyl, $\text{C}_3\text{-C}_{20}$ cycloalkyl, $\text{C}_6\text{-C}_{20}$ aryl, $\text{C}_7\text{-C}_{20}$ alkylaryl or $\text{C}_7\text{-C}_{20}$ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a $\text{OR}'\text{O}$ group wherein R' is a divalent radical selected from $\text{C}_1\text{-C}_{20}$ alkylidene, $\text{C}_6\text{-C}_{40}$ arylidene, $\text{C}_7\text{-C}_{40}$ alkylarylidene and $\text{C}_7\text{-C}_{40}$ arylalkylidene radicals;

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, and C₇-C₂₀ arylalkylidene radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, and silylidene radical containing up to 5 silicon atoms;

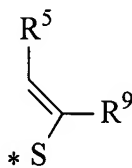
R¹ and R³, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R² and R⁴, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

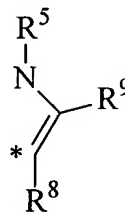
T¹ and T², equal to or different from each other are a moiety of formula (II), (III) or (IV):



(II)



(III)



(IV)

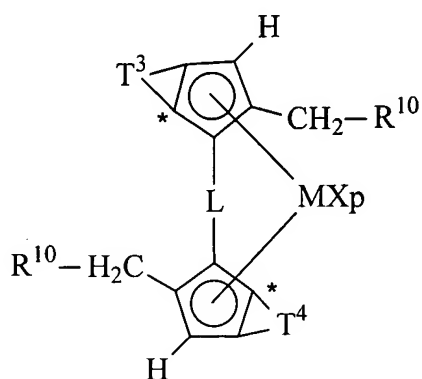
wherein the atom marked with the * is bound to the atom marked with the same symbol bonds in formula (I);

R⁵, R⁶, R⁷, R⁸ and R⁹, equal to or different from each other, are hydrogen atoms, or a linear or branched saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₄₀-aryl, C₇-C₄₀-alkylaryl, C₇-C₄₀-arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R⁶ and R⁷ can also join to form a saturated or unsaturated condensed 5 to 7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; and

- b) at least an alumoxane or a compound that forms an alkylmetallocene cation,
wherein an alpha olefin content of the isotactic 1-butene copolymer is at most 30% by mol.

- 2 (previously presented) The process according to claim 1 wherein the catalyst system further comprises an organo aluminum compound.
- 3 (previously presented) The process according to claim 1 wherein in the compound of formula (I), M is titanium, zirconium or hafnium; X is a hydrogen atom, a halogen atom or a R group; L is selected from the group consisting of Si(CH₃)₂, SiPh₂, SiPhMe, SiMe(SiMe₃), CH₂, (CH₂)₂, (CH₂)₃ and C(CH₃)₂ and R⁹ is a hydrogen atom or a linear or branched saturated or unsaturated C₁-C₂₀-alkyl radical.
- 4 (previously presented) The process according to claim 1 wherein the metallocene compound has formula (V):

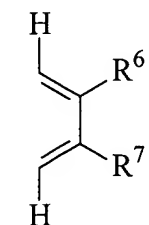


(V)

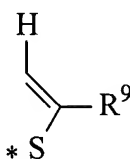
wherein

R¹⁰, equal to or different from each other, are hydrogen atoms, or linear or branched saturated or unsaturated C₁-C₁₉-alkyl, C₃-C₁₉-cycloalkyl, C₆-C₁₉-aryl, C₇-C₁₉-alkylaryl, C₇-C₁₉-arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

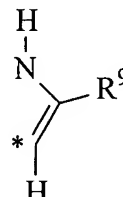
T³ and T⁴, equal to or different from each other are moieties of formula (Va), (Vb) or (Vc):



(Va)



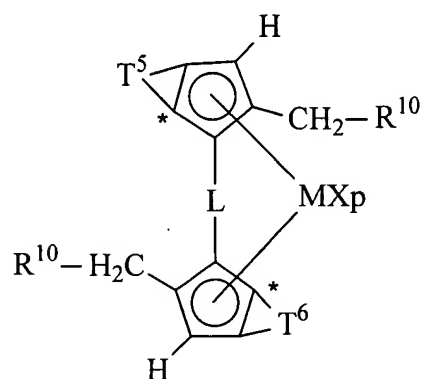
(Vb)



(Vc)

wherein the atom marked with the symbol * is bound to the atom marked with the same symbol in formula (V).

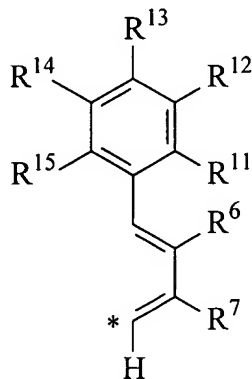
- 5 (previously presented) The process according to claim 4 wherein in the compound of formula (V), R^{10} is a hydrogen atom or a C_1 - C_{19} -alkyl radical; R^6 , R^7 are hydrogen atoms or linear or branched saturated or unsaturated C_1 - C_{20} -alkyl radicals, or they form a saturated or unsaturated 5 or 6 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; and R^9 is a linear or branched saturated or unsaturated C_1 - C_{20} -alkyl radical.
- 6 (previously presented) The process according to claim 1 wherein the metallocene compound has formula (VI):



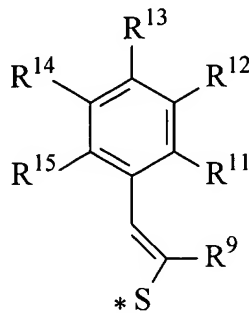
(VI)

wherein R^{10} , equal to or different from each other, are hydrogen atoms, or linear or branched saturated or unsaturated C_1 - C_{19} -alkyl, C_3 - C_{19} -cycloalkyl, C_6 - C_{19} -aryl, C_7 - C_{19} -alkylaryl, C_7 - C_{19} -arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

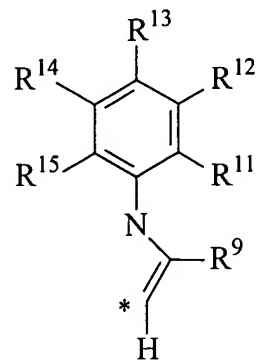
T^5 and T^6 , equal to or different from each other are a moiety of formula (VIa), (VIb) or (VIc):



(VIa)



(VIb)



(VIc)

wherein the atom marked with the symbol * is bound to the atom marked with the same symbol in formula (VI);

R^{11} , R^{12} , R^{13} , R^{14} , and R^{15} , equal to or different from each other, are hydrogen atoms or linear or branched saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl, C_7 - C_{20} -arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, or two adjacent groups form together a saturated or unsaturated condensed 5 or 6 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements.

- 7 (previously presented) The process according to claim 6 wherein R^6 and R^7 are hydrogen atoms or linear or branched saturated or unsaturated C_1 - C_{20} -alkyl radicals; or they form a saturated or unsaturated 5 or 6 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; R^9 is a hydrogen atom or a linear or branched saturated or unsaturated C_1 - C_{20} -alkyl radical; R^{11} is a C_1 - C_{20} -alkyl radical; R^{14} is a hydrogen atom or a C_1 - C_{20} -alkyl radical; and R^{12} , R^{13} and R^{15} are hydrogen atoms.
- 8 (previously presented) The process according to claim 1 wherein the alpha-olefin is selected from 1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene, 4,6-dimethyl-1-heptene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, 1-octadecene and 1-eicosene.
- 9 (previously presented) The process according to claim 8 wherein the alpha-olefin is selected from 1-pentene, 1-hexene and 1-octene.
- 10 (previously presented) The process according to claim 1 wherein the content of the at least one alpha olefin derived units in the copolymer is from 2% to 20% by mol.
- 11 (withdrawn) An isotactic 1-butene copolymer having a content up to 30% by mol of at least one alpha-olefin of formula $CH_2=CHZ$ derived units, wherein Z is a C_3 - C_{20} hydrocarbon group having the following features:
 - (i) isotactic pentads (mmmm) >90%; and
 - (ii) a percentage of soluble fraction in diethylether (%SD) and a molar content of said alpha olefins (%O) in the polymer chain meeting the following relation:
$$\%SD > 2.8\%O + 8.$$
- 12 (withdrawn) The isotactic 1-butene copolymer according to claim 11 wherein the percentage of soluble fraction content in diethylether (%SD) and the molar content of said alpha olefins (%O) in the polymer chain meet the following relation:

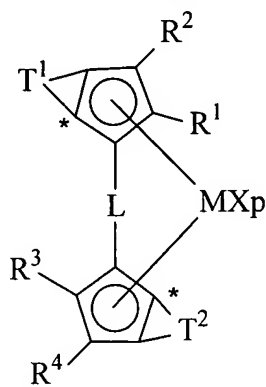
$$\%SD > 2.8\%O + 10.$$

13. (withdrawn) The isotactic 1-butene copolymer according to claim 11 wherein the content of alpha-olefin derived units are comprised between 10% and 30% by mol and the percentage of soluble fraction in diethylether >92%.
14. (withdrawn) The isotactic 1-butene copolymer according to claim 11 wherein the content of alpha-olefin derived units are comprised between 5% and 12% by mol and the percentage of soluble fraction in diethylether >41%.
15. (withdrawn) An isotactic 1-butene copolymer having a content up to 30% by mol of units derived from at least one alpha olefin of formula $\text{CH}_2=\text{CHZ}$, wherein Z is a $\text{C}_3\text{-C}_{20}$ hydrocarbon group having the following features:
 - (i) isotactic pentads (mmmm) >90%; and
 - (ii) presence of 4,1 insertions in the polymer chain.
16. (withdrawn) An isotactic 1-butene copolymer having a content up to 30% by mol of at least one alpha-olefin of formula $\text{CH}_2=\text{CHZ}$ derived units, wherein Z is a $\text{C}_3\text{-C}_{20}$ hydrocarbon group having the following features:
 - (i) isotactic pentads (mmmm) >90%; and
 - (ii) a percentage of soluble fraction in diethylether (%SD) and a molar content of said alpha olefins (%O) in the polymer chain meeting the following relation:

$$\%SD > 2.8\%O + 8,$$

produced by a process comprising contacting 1-butene and the at least one alpha olefin under polymerization conditions, in the presence of a catalyst system obtained by contacting:

- a) at least a metallocene compound of formula (I):



(I)

wherein

M is a transition metal belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

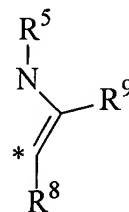
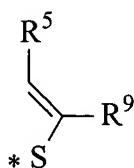
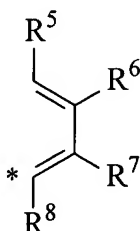
X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO₂CF₃, OCOR, SR, NR₂ or PR₂ groups, wherein R is a linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR'O group wherein R' is a divalent radical selected from C₁-C₂₀ alkylidene, C₆-C₄₀ arylidene, C₇-C₄₀ alkylarylidene and C₇-C₄₀ arylalkylidene radicals;

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, and C₇-C₂₀ arylalkylidene radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, and silylidene radical containing up to 5 silicon atoms;

R¹ and R³, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R² and R⁴, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

T¹ and T², equal to or different from each other are a moiety of formula (II), (III) or (IV):



(II)

(III)

(IV)

wherein the atom marked with the * is bound to the atom marked with the same symbol bonds in formula (I);

R^5 , R^6 , R^7 , R^8 and R^9 , equal to or different from each other, are hydrogen atoms, or a linear or branched saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{40} -aryl, C_7 - C_{40} -alkylaryl, C_7 - C_{40} -arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^6 and R^7 can also join to form a saturated or unsaturated condensed 5 to 7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; and

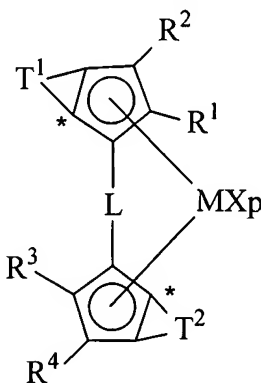
b) at least an alumoxane or a compound that forms an alkylmetallocene cation.

17. (withdrawn) An isotactic 1-butene copolymer having a content up to 30% by mol of units derived from at least one alpha olefin of formula $CH_2=CHZ$, wherein Z is a C_3 - C_{20} hydrocarbon group having the following features:

- (i) isotactic pentads (mmmm) >90%; and
- (ii) presence of 4,1 insertions in the polymer chain,

produced by a process comprising contacting 1-butene and the at least one alpha olefin under polymerization conditions, in the presence of a catalyst system obtained by contacting:

a) at least a metallocene compound of formula (I):



(I)

wherein

M is a transition metal belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

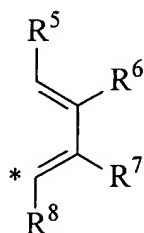
X, equal to or different from each other, are hydrogen atoms, halogen atoms, or R, OR, OSO₂CF₃, OCOR, SR, NR₂ or PR₂ groups, wherein R is a linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR'O group wherein R' is a divalent radical selected from C₁-C₂₀ alkylidene, C₆-C₄₀ arylidene, C₇-C₄₀ alkylarylidene and C₇-C₄₀ arylalkylidene radicals;

L is a divalent bridging group selected from C₁-C₂₀ alkylidene, C₃-C₂₀ cycloalkylidene, C₆-C₂₀ arylidene, C₇-C₂₀ alkylarylidene, and C₇-C₂₀ arylalkylidene radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, and silylidene radical containing up to 5 silicon atoms;

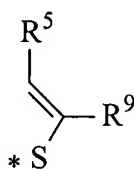
R¹ and R³, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R² and R⁴, equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₂₀ alkyl, C₃-C₂₀ cycloalkyl, C₆-C₂₀ aryl, C₇-C₂₀ alkylaryl or C₇-C₂₀ arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

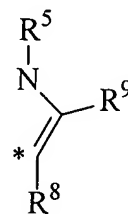
T¹ and T², equal to or different from each other are a moiety of formula (II), (III) or (IV):



(II)



(III)



(IV)

wherein the atom marked with the * is bound to the atom marked with the same symbol bonds in formula (I);

R^5 , R^6 , R^7 , R^8 and R^9 , equal to or different from each other, are hydrogen atoms, or a linear or branched saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{40} -aryl, C_7 - C_{40} -alkylaryl, C_7 - C_{40} -arylalkyl radicals, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^6 and R^7 can also join to form a saturated or unsaturated condensed 5 to 7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; and

b) at least an alumoxane or a compound that forms an alkylmetallocene cation.